Remarks

The claimed invention

The present invention is directed to a novel fault current limiter comprising a superconducting composite. The composite includes an oxide superconducting member and an electrically conductive member substantially surrounding the superconducting member. (The electrically conductive member is hereinafter referred to as the "matrix." This designation is solely for convenience and is not intended to limit the structure or function of the member).

The superconducting composite has an operating current selected to be greater than or equal to about one-half the critical current of the superconducting member, and less than or about equal to the critical current of the superconducting member. The oxide superconducting member and the matrix are selected such that when the composite experiences a fault current of about 3-10 times the operating current, the electric field in the composite is in the range of about 0.05-0.5 V/cm. Since the minimum value of the operating current is about half the critical current, and the fault current is at least about three times the operating current, the fault current must exceed the critical current of the superconducting member.

In typical use as fault current limiters, the oxide superconductor is selected to have an operating current slightly in excess of normal peak loads for a system. In the event of a short-circuit fault current, the critical current is rapidly exceeded, and the superconducting component reverts to its normal high resistivity. Current is then shunted through the matrix, which has a sufficiently high resistivity to exhibit the claimed electric fields.

Rejections under 35 U.S.C. § 102

Claims 1-5, 10, 11, 18, and 25 stand rejected under 35 U.S.C. § 102(b) as anticipated by Shiga. This rejection is respectfully traversed for the reasons set forth below.

Shiga describes an oxide superconductor wire and a method of making such a wire. The wire includes both a low conductivity and a high-conductivity sheath surrounding a superconducting member. (As used by Shiga, "conductivity" refers either to thermal or to electrical conductivity). The low conductivity portion suppresses eddy currents and reduces

coolant evaporation, while the high conductivity portion acts as a heat sink and as a current bypath (col. 1, lines 21-43; col. 2, lines 45-55; col. 5, lines 38-53).

Independent claim 1, and claims 2-5, 10, 11, 18, and 25 which depend directly or indirectly from claim 1, recite a superconducting composite comprising an oxide superconducting member and an electrically conductive member substantially surrounding the oxide superconducting member. The composite must meet certain current-electric field limitations described above.

The Office Action states that the claimed range of electric field and the range of operating current are inherent properties of the superconductor as described by Shiga. Applicant respectfully disagrees. "Inherency, however may not be established by probabilities or possibilities. The mere fact that a certain thing *may* result from a given set of circumstances is not sufficient." Contintental Can v. Monsanto, 20 USPQ2d 1746, 1749 (Fed. Cir. 1991), quoting In re Oelrich, 212 USPQ 323, 326 (CCPA 1981) (emphasis in original).

The fact that both Shiga and Applicant disclose an oxide superconductor and sheath having a parallel electrical connection is not sufficient to establish that Shiga inherently anticipates the present invention, as suggested by the Office Action. These connections are established for different purposes, and the device of Shiga would not need to attain the claimed values in order to function as disclosed in that reference. The recited voltage drop of the composite during a fault event is a function of the resistivity of the sheath, the resistivity of the oxide superconductor in its nonsuperconducting state, and of the cross-sectional areas of each. There is no teaching in Shiga that these parameters should be selected to achieve the voltage drop recited in the present claims, and no reason to believe that such a voltage drop would actually be achieved by any of Shiga's examples. "A reference includes an inherent characteristic if that characteristic is the 'natural result' flowing from the reference's explicitly explicated limitations." *Id.* at 1749. In this case, the characteristic is not a "natural result," but requires additional selection and manipulation of properties not considered by Shiga. Thus, it cannot be inherently anticipated.

Further, Applicant can find no basis for the statement in the Office Action that "[d]uring abrupt current increase, the device's resistivity reaches 25 $\mu\Omega$-cm." This statement was made

without citation and cannot be found in the text of Shiga. To the extent that Shiga discloses resistivities at all, they are disclosed as relative to the high-conductivity portion of the composite, as shown in Table 1. The highest resistivity suggested by this table is 3.5 times the resistivity of pure silver, or about 5.6 $\mu\Omega$-cm (silver has a resistivity of approximately 1.6 $\mu\Omega$-cm).

For at least these reasons, Applicant respectfully requests that all rejections under 35 U.S.C. § 102(b) be reconsidered and withdrawn.

Rejections under 35 U.S.C. § 103

Claims 6-9, 12-17, 19-24, and 26-31 stand rejected under 35 U.S.C. § 103(a) as obvious over Shiga in view of Fillunger and Puhn. All rejections under 35 U.S.C. § 103(a) are respectfully traversed for the reasons set forth below.

As discussed above, Shiga does not disclose or suggest the limitations on electric field in the presence of a fault current recited in claim 1, from which all claims rejected under 35 U.S.C. § 103(a) depend. This defect is not remedied by Fillunger or Puhn. Fillunger describes a non-oxide (low T_c) superconducting cable, which is mechanically reinforced by solder (Fig. 4; col. 3, lines 53-57) and a stainless steel plate (Fig. 4 at 12; col. 3, lines 51-52). Both the stainless steel plate and the solder are disclosed to provide *mechanical* stabilization, rather than *thermal* stabilization. Puhn is also directed to mechanical stabilization of non-oxide (low T_c) superconductive cables. Neither Fillunger nor Puhn contains any suggestion that the *electrical* or *thermal* properties of the cables can be optimized in the presence of fault currents, as recited in the pending claims, let alone suggesting particular desirable values for the electric field (all claims), heat capacity (claims 12-17 and 26-31), or heat transfer coefficient (claims 19-24 and 26-31).

For at least these reasons, Applicant respectfully requests that all rejections under 35 U.S.C. § 103(a) be reconsidered and withdrawn.

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Respectfully submitted,

Elizabeth E. Nugent
Registration Number 43,839
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Choate, Hall & Stewart
Exchange Place
53 State Street
Boston, MA 02109
(617) 248-5000
3626976_1.DOC